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Review of the economic viability of investing and exploiting biogas electricity plant – Case study Vizelj, Serbia

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ABSTRACT

Construction and operation of plants that produce energy from renewable energy sources is the subject for discussion in all the countries that have accepted the sustainable development concept and Kyoto protocol as their own development direction. Enlargement of the renewable energy production is clearly an imperative, but only economically viable construction and operation can result in long-term sustainability, which is initially the goal when deciding upon such investments. In line with this goal, this paper presents the estimation of the economic viability of constructing and operating biogas electricity plant on the farm Vizelj in Serbia. The timeframe for this estimation is from 2011 until 2020. This paper also presents all parameters which are necessary for performing this estimation, respectively, analysis of revenues and expenditures, projection of economic and financial flow, ratio analysis, dynamic and static analysis, and analysis of sensitivity of the project, i.e. impact of the changes in prices and raw material on the overall performance of the project. The observed investment is predicted to be financed from the EBRD's credit line for renewable energy in Western Balkans, while the total investment is estimated at Euro 958,000.00. After the performed economic assessment, the conclusion is that the observed investment in biogas electricity plant is very acceptable and it can serve as a role model for similar investments in the region.

Contents

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1. Introduction

The subject of this paper is to research the economic indicators of constructing and operating a biogas electricity plant [1,2]. It is assumed that the energy is produced from the slaughterhouse confiscate, that will be provided from own meat processing facility IMES from Padinska Skela [3]. The capacity of the envisaged plant is 250 kW/h. Except for the heat, it is estimated that the capacity utilization would be 75%. The project also estimates that the heat generated from the biogas electricity plant shall be used for heating the nearby farm. During the regular operation process of the biogas electricity plant, 51.88% of the heat is consumed for heating the plant itself. The rest 48.12%, i.e. 1037.6 MWh is at the outside consumer's disposal. The financial data is given in Euros.

In line with the Law on Energy of the Republic of Serbia, producers of energy from renewable sources have the status of privileged producers [4,5]. Therefore, buying this energy is obligatory for the state owned electricity sector, and this cycle is under the state control [6]. Feed-in tariff for the given case on the Vizelj farm is c€ 15.82 per kWh, during the 2011–2020 period. The initial phase in the evaluation of the economic viability of such venture is to define basic production parameters, and these are estimated sales and estimated prices. In the following table, the overview of estimated sales is presented (annual quantities) (Tables 1 and 2).

2. Required investments and financing

Investing in the biogas electricity plant has been estimated at the total amount of Euro 958,950. This amount consists of the investments into fixed and current assets (Tables 3 and 4).

Out of the total investment, loan was envisaged in the amount of Euro 809,214.69. The investor would finance part of construction works from own sources, which will amount to Euro 149,735.31 (15.61% of the total investment) (Table 5).

Dynamics of settling liabilities towards financing sources is based on the financing conditions of the appropriate EBRD's credit line. Table 6 provides the financing conditions.

For financing this biogas electricity plant, the loan will last 5 years, with the grace period of one year. Payback plan is presented in Table 7.

3. Revenues and expenditures

Defining economic viability of the exploiting electricity plant based on biogas conversion starts with the estimation of expected revenues and expenditures.

3.1. Total revenues

Total revenues have been estimated for the project life cycle, and the results are presented in Table 8.

When looking at Table 6, it can be seen that the smallest revenue will happen in the first year, 20% only. During the second year, somewhat larger revenue is expected, and it is supposed to result in receiving the success fee for finishing the project. Following revenues, over the next 8 years period, will be stable, and will amount to Euro 355,292 annually.

3.2. Total expenditures

Expected expenditures in running the biogas electricity plant are raw material, workforce, maintenance, certification, approval of the lowering emission, interest, other expenditures, and taxes (Table 9).

Other costs of doing business include the fees for selling CERs, and they amount to Euro 3000 annually.

Corporate profit tax has been estimated at 10%.

4. Synthetic financial report

Estimating economic viability of doing business has been conducted by preparation and analysis of the P/L Statement, Balance Sheet, and cash flow and free cash flow. These are given in Tables 10–13.

Table 2
Prices of the projected outputs from the given plant.

Product	Unit	Price
Electricity (MWh)	MWh	158.20 €
Heat (Sm3)	Sm3	0.30 €
CERs	Kom.	11.00 €
Removing slaughterhouse confiscate (t)	t	47 €

Table 3
Required fixed assets.

Fixed assets	December 31st 2010	March 31st 2011	
Real estate	0.00	149,735	149,735
Technological equipment	139,752	111,802	27,950
Mechanical equipment	32,201	25,760	6440
Electrical equipment	150,701	75,350	25,116
IT equipment	0.00	32,201	32,201
Total investment (Eur)	**322,655.44**	**394,850.40**	**241,444**

Table 1
Estimated annual sales of electricity.

Products	2011	2012	2013	2014–2020
Electricity (MWh)	271	1359	1365	1369
Heat (Sm3)	26,961	61,657	61,943	62,424
CERs	2149	8818	8823	8827
Removing slaughterhouse confiscate (t)	90	450	472	486

In Table 2, the overview of the projected prices is presented.

Table 4
Required current assets.

Current assets	Days	Coef	Amount 2011	Amount 2012	Amount 2013	Amount 2014
I Business related current assets			10.387	52.281	49.232	49.436
Buyers			8.193	39.140	39.402	39.566
Electricity (MWh annually)	60	6	7.167	35.836	36.003	36.102
Heat (Sm3)	30	12	674	1.541	1.548	1.560
Confiscate removal (t)	30	12	352	1.762	1.850	1.903
Cash	10	36	2.193	13.140	9.829	9.869
II Sources of current assets			1.468,25	5.727,99	6.106,24	6.121,99
Suppliers			588	2.207	2.234	2.249
Confiscate	30	12	105	525	551	567
Maintenance of the investment	30	12	358	1.432	1.432	1.432
Other expenditures–CER fees	30	12	125	250	250	250
Salaries	30	12	880	3.520	3.872	3.872
Amount of continuous current assets (I–II)			8.919	46.553	43.125	43.314
Difference year by year				37.633	−3.427	188

Table 5
Overview of the investments.

Type of investment	Amount (Euro)	Own sources	Loan
Real estate	299,470	149,735	149,735
Technological equipment	279,505	–	279,505
Mechanical equipment	64,402	–	64,402
Electrical equipment	251,168	–	251,168
IT equipment	64,402	–	64,402
Total investment	958,950	149,735	809,214
Total investment	100%	**15.61%**	**84.39%**

Table 6
Financing conditions.

Period	5 years
Annual interest rate	6.5%
Processing fee	1%
Moratorium	9 months
Grace period	9 months (September 30th 2011–June 30th 2012)
Payback type	Equal installments (30.6.2012–31.12.2015)
Payback dynamics	Monthly
Success fee upon completion 15%	€121,382.20 (2012)

The P/L statement clearly shows that the EBRD's funds will come to the project in the moment when they are most necessary – during the second year of the project. At that time, own funds will already be heavily exploited by investing, while the revenues will still be small and not stable. Percentage of net profit is high, and figures between 41% and 53%. After analyzing P/L statement, cash flow has been observed with all its elements. It is given in Table 11.

Cash flow analysis shows expected changes for a project of this kind. Clearly, during the first two years the flow is positive, and this is primarily the result of the EBRD's investment. After that, from third until fifth year, the project enters the critical phase and records negative net flows. After the fifth year, positive values show up and remain until the end of the observation period.

When looking at the balance sheet, it is clear that most investment is in fixed assets. On the other hand, long term liabilities are almost 4 times larger than short term ones. This is of course quite favorable from the investor's point of view. Besides, after the year 2014, the project is free of liabilities.

5. Financial analysis

Based on the projected synthetical financial reports, it is possible to quantify and analyze the indicators of business performances of the biogas electricity plant. Table 14 gives an overview of the most common ratio analysis.

Having in mind that activating fixed assets is envisaged as for the 1st of October 2011, investments are discounted to net present value as for 30th of September 2011. Chosen discount rate is 8% (Table 15).

As a base for calculating dynamic indicators of efficiency, net inflows have also been discounted, and this is presented in Table 16.

5.1. Net present value

The difference between the investment and net inflows from the project is positive, and it amounts to €**893,006.31**. Based on the criterion NPV > 0, this investment is acceptable for financing.

5.2. Profitability index

$$\mathrm{PI} = \frac{\mathrm{NPV}}{\mathrm{SVU}} = \frac{893,006}{854.37} = 104.55$$

5.3. Internal rate of revenue

Present value of the expected net economic flow has been equalized with the NPV of the investment at the discount rate of 22.13%. Having in mind that the IRR is greater than the initial discount rate, this project is acceptable for financing.

The project results in the average rate of annual yield over the engaged capital of **22.13%**.

5.4. Disscounted payback period – DPP

Present value of the net inflows from economic flow reaches the amount of NPV of the project in 2015.

$$\mathrm{DPP} = 4.25\,\text{year} + \frac{13,324.38}{(13,324.28 + 151,708.41)} = 4.33\,\text{year}$$

It is shown in Table 17.

Investment payback period is 4 years and 51 day.

Table 7
Long term and short term liabilities at the end of the year (period 2011–2015).

Date	December 31st 2011	December 31st 2012	December 31st 2013	December 31st 2014
Short term liabilities	119,498.83 €	238,997.66 €	238,997.66 €	238,997.66 €
Long term liabilities	716,992.99 €	477,995.33 €	238,997.66 €	–

Table 8
Expected revenues of the biogas electricity plant (2011–2020).

Assortment	MU	Sales	Price/MU	Total revenue
2011				
Electricity	MWh	271	158	43,004
Heat	Sm3	26,961	0.30	8088
CERs	kom	2149	11	23,648
Removing slaughterhouse confiscate	t	90	47	4230
Total revenues				78,971
2012				
Electricity	MWh	1359	158	215,020
Heat	Sm3	61,657	0.30	18,497
CERs-Approval of lower emissions	kom	8818	11	97,007
Removing slaughterhouse confiscate	t	450	47	21,150
Success fee		1		121,382
Total revenues				473,057
2013				
Electricity	MWh	1365	158	216,018
Heat	Sm3	61,943	0.30	18,583
CERs	kom	8823	11	97,063
Removing slaughterhouse confiscate	t	472	47	22,207
Total revenues				353,872
2014–2020				
Electricity	MWh	1369	158	216,616
Heat	Sm3	62,424	0.30	18,727
CERs-approval of lower emissions	kom	8827	11	97,107
Removing slaughterhouse confiscate	t	486	47	22,842
Total revenues				355,292

Table 9
Estimated annual expenditures.

Raw material	Price	2011	2012	2013	2013–2020
Raw material related expenditures – confiscate					
Confiscate supply	14.00 €/t	1260	6300	6615	6804

Job	Education	No	
Workforce related expenditures			
Total	High school	5	42,240

Type of expenditure	Amount of the investment	Life expectancy	Annual cost of maintenance	
Maintenance				
Real estate	299,470	25	1.0%	2994
Processing equipment	279,505	10	2.0%	5590
Mechanical equipment	64,402	20	1.5%	966
Electrical equipment	251,168	20	2.0%	3767
IT equipment	64,402	10	5.0%	3220
Total	958,950			16,538

Type of the investment	Amount	Interest	Bank fee	Total initial amount
Depreciation				
Real estate	–	5047	1497	306,015
Processing equipment	299,470	9421	2795	291,722
Mechanical equipment	279,505	2170	644	67,217
Electrical equipment	64,402	8466	2511	262,147
IT equipment	251,168	2170	644.02	67,217
Total	64,402	27,277	8092	994,319

Type of the investment	Total initial amount	Period	Annual interest	
Depreciation				
Real estate	306,015	25	4%	12,240
Processing equipment	291,722	10	10%	29,172
Mechanical equipment	67,217	20	5%	3360
Electrical equipment	262,147	20	5%	13,107
IT equipment	67,217	10	10%	6721
Total	994,319			64,602
Costs of certifying CERs				15,000

Year	2011	2012	2013	2014	2015
Cost of interest					
Cost of interest	13,204	51,244	38,354	23,264	8173

Table 10
Balance sheet.

	2011	2012	2013	2014	2015	2016–2020
Revenues						
Electricity	43,004	215,020	216,018	216,616	216,616	216,616
Heat	8088	18,497	18,583	18,727	18,727	18,727
CERs	23,648	97,007	97,063	97,107	97,107	97,107
Confiscate removal	4230	21,150	22,207	22,842	22,842	22,842
EBRD donation	–	121,382	–	–	–	–
Total revenues	78,971	473,057	353,872	355,292	355,292	355,292
Expenditures						
Raw material	1260	6300	6615	6804	6804	6804
Labor	10,560	42,240	46,464	46,464	46,464	46,464
Depreciation	16,150	64,602	64,602	64,602	64,602	64,602
Maintenance	4134	16,538	16,538	16,538	16,538	16,538
CER verification	15,000	15,000	15,000	15,000	15,000	15,000
Other expenditures	1500	3000	3000	3000	3000	3000
Interest	13,204	51,244	38,354	23,264	8173	–
Total expenditures	61,809	198,925	190,575	175,673	160,583	152,409
Gross profit	17,162	274,131	163,297	179,619	194,709	202,883
Profit tax (10%)	1716	27,413	16,329	17,961	19,470	20,288
Net profit	15,445	246,718	146,967	161,657	175,238	182,595
% of net profit	19.56%	52.15%	41.53%	45.50%	49.32%	51.39%

Table 11
Cash flow.

	Years									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Inflow from sales	78,971	473,057	353,872	355,292	355,292	355,292	355,292	355,292	355,292	355,292
Residual value										396,743
Total inflow	78,971	473,057	353,872	355,292	355,292	355,292	355,292	355,292	355,292	752,036
Raw material	1260	6300	6615	6804	6804	6804	6804	6804	6804	6804
Labor	10,560	42,240	46,464	46,464	46,464	46,464	46,464	46,464	46,464	46,464
Maintenance	4134	16,538	16,538	16,538	16,538	16,538	16,538	16,538	16,538	16,538
CER verification	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Other outflows	1500	3000	3000	3000	3000	3000	3000	3000	3000	3000
Interest	13,204	51,244	38,354	23,264	8173	0.00	0.00	0.00	0.00	0.00
Loan installment		119,498	238,997	238,997	238,997	0.00	0.00	0.00	0.00	0.00
Profit tax	1716	27,413	16,329	17,961	19,470	20,288	20,288	20,288	20,288	20,288
Total outflow	47,374	281,234	381,299	368,030	354,449	108,094	108,094	108,094	108,094	108,094
Net outflow	31,596	191,822	−27,427	−12,737	843.78 €	247,198	247,198	247,198	247,198	643,941
Cumulative net inflow	31,596	223,419	195,991	183,254	184,097	431,295	678,493	925,691	1,172,889	1,816,831

Table 12
Balance sheet.

	Years				
	2011	2012	2013	2014	2015
Assets (A + B)	1,020,152	1,189,266	1094,186	1,017,050	953,291
A. Fixed assets	978,168€	913,565	848,962	784,360	719,757
Facilities	302,955	290,714	278,473	266,233	253,992
Technology equipment	284,429	255,257	226,085	196,912	167,740
Equipment works	66,376	63,016	59,655	56,294	52,933
Electrical equipment	258,870	245,762	232,655	219,548	206,440
IT equipment	65,536	58,815	52,093	45,371	38,649
B. Current assets	41,984	275,700	245,223	232,690	233,534
Receivables	8193	39,140	39,402	39,566	39,566
Cash	2193	13,140	9829	9869	9869
Cash from inflow	31,596	223,419	195,991	183,254	184,097
Liabilities (C + D + E)	1,020,152	1,189,266	1,094,186	1,017,050	953,291
C. Equity	182,206	466,599	610,139	771,985	947,224
D. ST liabilities	120,953	244,670	245,049	245,064	6,067
Suppliers	574	2153	2179	2195	2195
Labor	880	3520	3872	3872	3872
Part of the loan	119,498	238,997	238,997	238,997	–
E. LT liabilities	716,992	477,995	238,997	0.00	0.00
Part of the loan	716,992	477,995	238,997	–	–

Table 13
Economic flow.

Economic flow	0	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Sales		78,971	473,057	353,872	355,292	355,292	355,292	355,292	355,292	355,292	355,292
Residual value											396,743
Total inflow		78,971	473,057	353,872	355,292	355,292	355,292	355,292	355,292	355,292	752,036
Raw material		1260	6300	6615	6804	6804	6804	6804	6804	6804	6804
Labor		10,560	42,240	46,464	46,464	46,464	46,464	46,464	46,464	46,464	46,464
Maintenance		4134	16,538	16,538	16,538	16,538	16,538	16,538	16,538	16,538	16,538
Verification of CERs		15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Other		1500	3000	3000	3000	3000	3000	3000	3000	3000	3000
Interest		13,204	51,244	38,354	23,264	8173	0.00	0.00	0.00	0.00	0.00
Profit tax		1716	27,413	16,329	17,961	19,470	20,288	20,288	20,288	20,288	20,288
Total outflow		47,374	161,736	142,301	129,032	115,451	108,094	108,094	108,094	108,094	108,094
Net flow		31,596	311,321	211,570	226,260	239,841	247,198	247,198	247,198	247,198	643,941
Investment	**994,319**	–	–	–	–	–	–	–	–	–	–
Cumulative inflow	−994,319	−962,722	−651,401	−439,831	−213,570	26,270	273,468	520,666	767,864	1,015,062	1,659,003
Return period	**4.14**										
Discount factor	8.00%										
Accumulation factor		1.02	1.10	1.19	1.28	1.39	1.50	1.62	1.75	1.89	2.04
Discounted inflow		30,994	282,767	177,930	176,189	172,931	165,032	152,808	141,489	131,008	315,992
Investment – discounted amount	854.137										
Discounted cumulative inflow	−854,137	−823,143	−540,376	−362,445	−186,255	−13,324	151,708	304,516	446,005	577,013	893,006
NPV	**893,006**										
Discounted return period	**4.33**										
	−854,137	3159	311,321	211,570	226,260	239,841	247,198	247,198	247,198	247,198	643,941
IRR	**22.13%**										
Profitability index	**104.55%**										

Table 14
Ratio analysis.

Indicators	2011	2012	2013	2014	2015
Liquidity					
General liquidity ratio	0.35	1.13	1.00	0.95	38.49
Strict liquidity ratio	0.35	1.13	1.00	0.95	38.49
Net current assets (EUR)	−78,969	31,029	174	−12,374	227,466
Activity					
Turnover	9.64	12.09	8.98	8.98	8.98
Average delayed receivables	37.87	30.20	40.64	40.65	40.65
Turnover of suppliers	107.58	92.39	87.44	80.03	73.15
Average delayed payments	3.39	3.95	4.17	4.56	4.99
Financial structure					
Share of borrowed capital	82.14%	60.77%	44.24%	24.10%	0.64%
Long term sources/total sources	88.14%	79.43%	77.60%	75.90%	99.36%
Outflow/interest	2.30	6.35	5.26	8.72	24.82
Profitability					
Business profit rate	38.45%	68.78%	56.98%	57.10%	57.10%
Net profit rate	19.56%	52.15%	41.53%	45.50%	49.32%
Efficiency	127.77%	237.81%	185.69%	202.25%	221.25%
Yield/total assets	1.56%	22.33%	12.87%	15.31%	17.79%
Yield/own assets	9.31%	76.05%	27.30%	23.39%	20.39%

5.5. Breakeven point

To determine the breakeven point, 2014 has been taken as a representative year, because of the maximum capacity utilization. To calculate the breakeven point, costs have been separated into two groups – fixed and variable costs (Table 18), and also, rate of profit contribution has been determined.

Based on the given parameters, value and capacity breakeven points have been determined:

5.6. Value breakeven – VB

$$VB = \frac{FC}{PCR} = \frac{165,869.66}{97.28\%} = 170,576.57$$

FC is the fixed costs and PCD is the profit contribution rate.

5.7. Capacity breakeven – KB

$$KB = \frac{VB}{UP} = \frac{170,576.57}{353,872.13} = 48.01\%$$

5.7.1. Sensitivity analysis

Exploiting this type of plant has been observed over the ten years period. In the given timeframe, certain changes can happen and these can more or less affect the functioning of the project. Therefore, it is important to reach certain values of changes that the project is able to sustain. These changes in parameters are given in Table 19.

6. Overall criteria

In the process of estimating this project's viability, all inputs and outputs have been analyzed. Overall opinion about the project is based on the three groups of criteria: eliminating, functional, and descriptive.

6.1. Eliminating criteria

This group of criteria defines acceptable values of the dynamic efficiency indicators, whereby the IRR criterion is the crucial for decision making. Achieved values are given in Table 20.

Table 15
Dynamic efficiency indicators.

Investment date	Amount	Accumulation factor/discount factor	NPV September 30th 2011
31/12/2010	8092	1.059	8572.975
31/3/2011	149,735	1.039	155,609.498
31/7/2012	19,916	0.938	18,679.243
31/8/2012	19,916	0.932	18,559.829
30/9/2012	19,916	0.926	18,441.178
31/10/2012	19,916	0.920	18,323.285
31/11/2012	19,916	0.914	18,206.146
31/12/2012	19,916	0.908	18,089.756
31/1/2013	19,916	0.902	17,974.110
28/2/2013	19,916	0.897	17,859.204
31/3/2013	19,916	0.891	17,745.031
30/4/2013	19,916	0.885	17,631.589
31/5/2013	19,916	0.880	17,518.872
30/6/2013	19,916	0.874	17,406.876
31/7/2013	19,916	0.868	17,295.596
31/8/2013	19,916	0.863	17,185.027
30/9/2013	19,916	0.857	17,075.165
31/10/2013	19,916	0.852	16,966.005
30/11/2013	19,916	0.846	16,857.543
31/12/2013	19,916	0.841	16,749.774
/	,	.	
/	,	.	.
30/9/2015	19,916	0.735	14,639.201
31/10/2015	19,916	0.730	14,545.614
30/11/2015	19,916	0.726	14,452.626
31/12/2015	19,916	0.721	14,360.232
Ukupno	994,319		854,137.962

Table 16
Table of discounted net inflows.

Investment date	Net inflow (EUR)	Accumulation factor/discount factor	Discounted net inflow 30/09/2011	Cumulative discounted net inflow
30/09/2011	−854,138	1.00	−854,138	−854,138
31/12/2011	31,596	1.02	30,994	−823,143
31/12/2012	311,321	1.10	282,767	−540,376
31/12/2013	211,570	1.19	177,930	−362,445
31/12/2014	226,260	1.28	176,189	−186,255
31/12/2015	239,841	1.39	172,931	−13,324
31/12/2016	247,198	1.50	165,032	151,708
31/12/2017	247,198	1.62	152,808	304,516
31/12/2018	247,198	1.75	141,489	446,005
31/12/2019	247,198	1.89	131,008	577,013
31/12/2020	643,941	2.04	315,992	893,006

Table 17
Investment payback period.

Investment date	Net inflow	Cumulative net inflow
30/09/2011	−994,319.28	−994,319.28
31/12/2011	31,596.56	−962,722.71
31/12/2012	311,321.47	−651,401.24
31/12/2013	211,570.17	−439,831.07
31/12/2014	226,260.09	−213,570.98
31/12/2015	239,841.45	26,270.47
31/12/2016	247,198.01	273,468.48
31/12/2017	247,198.01	520,666.49
31/12/2018	247,198.01	767,864.51
31/12/2019	247,198.01	1,015,062.52
31/12/2020	643,941.39	1,659,003.91

Table 18
Breakeven parameters.

Costs	2014
Raw material	6804
Other costs–fees for selling CERs	3000
Variable costs	**9.804**
Labor	46.464
Depreciation	64.602
Maintenance	16.538
CERs	15.000
Interest	23.264
Fixed costs	**165.869**
Total costs	**175.673**
Total revenues	355.292
Variable costs	9.804
Profit contribution	345.488
Fixed costs	165.869
Gross profit	179.619
Rate of variable costs	2.76%
Profit contribution rate	**97.24%**

Based on this set of criteria, the project is profitable and acceptable.

6.2. *Functional criteria*

Project assessment based on the functional criteria entails liquidity and sensitivity analysis. Liquidity criterion requires paying all invoices on time. If the project is not liquid in each year of its lifecycle, then the project's functionality is secured by cumulative net inflow being positive. In the financial analysis has been identified that the project has negative net flow during 2013–2014, but during the previous years enough cash has been generated so that all duties can be covered. Taking into account that cumulative net flow during the whole lifecycle is positive, project can be declared as acceptable

Table 19
Sensitivity analysis.

Parameter	% change	IRR	NPV	Payback period
Basic value	0%	22.13%	893,006.31	4 years, 4 months
Selling prices	+5%	23.65%	994,263.77	4 years
Selling prices	+10%	25.14%	1,095,521.23	3 years, 9 months
Selling prices	−10%	19.00%	690,491.39	5 years, 1 months
Selling prices	−5%	20.58%	791,748.85	4 years, 8 months
Raw material prices	−5%	22.16%	894,910.40	4 years, 4 months
Raw material prices	−10%	22.19%	896,814.49	4 years, 4 months
Raw material prices	+10%	22.08%	889,198.13	4 years, 4 months
Raw material prices	+5%	22.10%	891,102.22	4 years, 4 months
Selling prices and raw material prices	−5% & −3%	20.60%	792,891.31	4 years, 8 months
Selling prices and raw material prices	−10% & −6%	19.04%	692,776.30	5 years, 1 month

Table 20
Eliminating criteria.

Indicators	Criterion	Project
IRR	>8%	22.13%
NPV	>0	893.006
Payback Period	<10 years	4.33 years

Sensitivity and risks of the project have been determined within the breakeven analysis and sensitivity analysis, and they are both acceptable.

Based on the given facts, it can be concluded that the investment in the biogas electricity plant is acceptable.

6.3. Descriptive criteria

Investor has organizational, know-how, and human resources to implement planned investments. Planned activities, schedule, and predicted deadlines for preparation and execution of the project are realistic. Expected business results are satisfactory. Besides positive financial effects, execution of such project has very positive effects upon the environment. All project idea is in accordance with Strategy of Sustainable Development in Serbia and region of SE Europe [7–9].

7. Conclusion

This project will be executed in line with the priorities of the Republic of Serbia that relate to Sustainable Development Strategy and Kyoto Protocol. Also, importance of the project is proven by the fact that EBRD's credit line for Western Balkans will be used for financing. By executing this project, i.e. by turning slaughterhouse confiscate into electricity, it will be possible to self-heat the slaughterhouse, while the rest of the electricity will be supplied to the electricity company of Serbia. This company, as a public company, is obliged to buy the RES electricity at the privileged prices by the Decree on the status of privileged electricity producers. Besides the given environmental indicators, detailed financial analysis has been done. All usual financial indicators have been estimated as very positive during the 10 years lifecycle. Also, after the sensitivity analysis has been done, it has been determined that there are no threats to the stability of this project whatsoever.

In line with the given opinion, this project can be considered as viable and completely acceptable, while its development will be carefully overviewed. Having in mind numerous historical, industrial, geographical and energy related similarities among the neighboring countries; this project could easily become a useful example to other investors in the region as well.

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